DOCUMENT RESUME

ED 420 968 EC 306 541

AUTHOR Cookson, John; Cylke, Frank Kurt; Dixon, Judith; Fistick, Robert E.; Fitzpatrick, Vicki; Kormann, Wells B.; Moodie, Michael M.; Redmond, Linda; Thuronyi, George

TITLE Digital Talking Books: Planning for the Future.

INSTITUTION Library of Congress, Washington, DC. National Library Service for the Blind and Physically Handicapped.

PUB DATE 1998-07-00

NOTE 77p.

AVAILABLE FROM Reference Section, National Library Service for the Blind and Physically Handicapped, Washington, DC 20542; telephone: 202-707-9275; fax: 202-707-0712; e-mail: nls@loc.gov

PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC04 Plus Postage.

DESCRIPTORS Adults; *Audiodisks; *Audiotape Recordings; Children; Federal Programs; Physical Disabilities; Program Implementation; *Reading Materials; *Talking Books; *Visual Impairments

IDENTIFIERS *Digital Audiotape; National Library Service for the Blind

ABSTRACT

This report describes the plans of the National Library Service for the Blind and Physically Handicapped (NLS) to convert their talking books service to a digitally based audio system. The NLS program selects and produces full-length books and magazines in braille and on recorded disc and cassettes and distributes them to a cooperating network of regional and subregional libraries, where they are circulated to eligible borrowers. The NLS plans to convert the talking book system to a digital system. The report outlines key factors in the design of the NLS system, steps in planning for the transition to a digital system, and design-phase tasks. Timing of introduction of the NLS digital talking books and the development of a technical standard for digital talking books through the National Information Standards Organization are also discussed. Examples of activities to test the effectiveness of the digital system are summarized and 20 steps of next-generation NLS technology are provided. The report emphasizes the need to involve consumers to gain feedback and describes methods of obtaining feedback. Appendices highlight details to be considered in implementing the digital talking-book program and a flow chart of the contracting process. (Contains 34 references.) (CR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 420 968

Digital Talking Books

Planning for the Future

July 1998

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

National Library Service for the Blind and Physically Handicapped • The Library of Congress

EC 306 541

Digital Talking Books: Planning for the Future

July 1998

John Cookson
Frank Kurt Cylke
Judith Dixon
Robert E. Fistick
Vicki Fitzpatrick
Wells B. Kormann
Michael M. Moodie
Linda Redmond
George Thuronyi

Published in braille, recorded, and large-print formats.

Copies available on request from:

Reference Section
National Library Service for the
Blind and Physically Handicapped
Washington, DC 20542
telephone: (202) 707-9275
e-mail: nls@loc.gov
fax: (202) 707-0712

Contents

Prologue 1
Frank Kurt Cylke

Planning for the Future 7
John Cookson and Michael M. Moodie

Working with the National Information Standards Organization 20
Robert E. Fistick, Vicki Fitzpatrick, and George Thuronyi

Digital Talking Book Technology: Activity Planning 37
John Cookson

Twenty Steps to Next-Generation NLS Technology 40
John Cookson

Nine Tasks to Implement the Use of Digital Talking Books 46
Wells B. Kormann

Consumer Involvement: Essential to Planning for the Future 50
Judith Dixon

Bibliography 60
Linda Redmond

Appendix I: Details to Be Considered in Implementing the Digital Talking Book Program 65
Wells B. Kormann

Appendix II: Federal Contracting Approach: An Overview 69

Digital Talking Books: Planning for the Future

Prologue

Background

On March 3, 1931, the Library of Congress was authorized to initiate the Books for the Adult Blind Project. On July 1 of the same year, the first braille titles for the collection were procured. In 1932, "talking books" were being developed by the American Foundation for the Blind, and a sound reproduction machine was produced in 1933. Free mailing of talking books was approved by Congress in 1934, and by 1935 the Library of Congress talking-book program was in full operation.

From its mandate in 1931 to serve blind adults, the program was expanded in 1952 to include children, in 1962 to provide music materials, and again in 1966 to include individuals with other physical impairments that prevent the reading of regular printed materials.

From an initial appropriation of $75,000 to be used for talking books, the free national library program's funding has grown to a level of nearly $47 million in fiscal year 1998.

Today under a special provision of the U.S. copyright law and with the permission of authors and publishers of works not covered by the provision, the National Library Service for the Blind and Physically Handicapped (NLS) within the Library of Congress selects and produces full-length books and magazines in braille and on recorded disc and cassette. Reading materials are distributed to a cooperating network of regional and subregional (local) libraries, where they are circulated to eligible borrowers. Reading materials and playback machines are sent to borrowers and returned to libraries by postage-free mail.

Funding

The NLS program is funded annually by the U.S. Congress. Regional and subregional libraries receive funding from federal, state, and local sources. Under an additional appropriation to the U.S. Postal Service, books and materials are mailed as "Free Matter for the Blind or Handicapped." The combined expenditure for the program exceeds $140 million annually.

Eligibility

Anyone unable to read or use standard printed materials as a result of temporary or permanent visual or physical limitations may receive service. In 1979, a survey sponsored by the Library of Congress found that two million persons with some type of visual impairment and another one million with physical conditions such as paralysis, missing hands or arms,

lack of muscle coordination, or prolonged weakness may be eligible to register for the service.

Book and Magazine Materials

Books are selected on the basis of their appeal to a wide range of interests. Bestsellers, biographies, fiction, and how-to books are in great demand. Fifty-five languages are represented by books in the collection. Registered borrowers learn of new books added to the collection through two bimonthly publications. Using a union catalog available on microfiche and in computerized form, users have access to the entire NLS book collection and to the resources of cooperating agencies worldwide.

Consumer Relations

A consumer relations office maintains regular contact with consumer groups and individual users of the program to identify and resolve service problems and to ensure that users' needs are met. Consumers contribute to program development by participating in surveys, evaluating new equipment, and serving on advisory committees. Those with a technical aptitude are also welcome to participate in audio-book development discussions.

Research and Development

The NLS research program is directed toward improving the quality of reading materials and playback equipment, controlling program costs, and reducing the time required to deliver services to users. Recent research

activities include (1) an evaluation of the braille and audio magazine program, (2) the development of a standard for digital talking books (DTBs), (3) a study of the application of digital techniques to NLS recorded material, and (4) the thorough investigation of recent and potential audio technologies for use in the program. The DAISY Consortium is working on many of the same issues surrounding the development of digital talking books. NLS is closely monitoring their work, participating in key committee meetings, and has included DAISY members in NISO working groups.

Users

In FY98, 784,000 users read braille and audio books and periodicals. Of that number, 752,000 read audio cassettes and flexible discs.

Audio Book Reading

Playback equipment is loaned free to readers for as long as they continue to borrow recorded materials provided by NLS and its cooperating libraries. Talking-book machines are designed to play disc books and magazines recorded at 8 rpm and 16 rpm; cassette machines are designed for cassettes recorded at 15/16 ips and the standard speed of 1-7/8 ips on 2 and 4 tracks. Readers with very limited mobility may request a playback machine with a remote-control unit. Hearing-impaired readers may be eligible for an auxiliary amplifier for use with headphones. A cassette machine designed primarily for persons with limited manual dexterity is available, as is one that plays both discs and cassettes. The inventory of

active audio machines exceeds 812,000 units (about 672,000 cassette players and 140,000 disc players) valued at approximately $99,254,000 when originally purchased.

Available reading materials listed in the NLS union catalog exceed 163,000 audio titles in approximately 16 million copies.

Future

Ever-changing audio technology requires that NLS always be aware of developments and prepare carefully for any systemic changes that may be desired or required. Usefulness, cost effectiveness, thoughtful stewardship, and educated oversight are the major criteria by which any audio reading program must be judged. Library of Congress/NLS professional staff work to apply these criteria to all facets of our program, with regular assistance from appropriate public- and private-sector experts.

Because any major change in the program will affect nearly three million eligible users and require several hundred million dollars in investment, any proposal for change must be carefully reviewed and evaluated.

The following pages describe in detail the Library of Congress/NLS approach to changing to digitally based audio technology. The staff strives to be thorough, imaginative, and open to influence by appropriate audio technology developments outside NLS.

The NLS approach is to have managers, engineers, technicians, librarians, and users bring varying perspectives and talents to bear on the challenge of developing the best possible talking-book program for the twenty-first century. Their efforts will result in a proposal for a Talking Book Digital Conversion Project, a project that will provide the best approach for developing a cost-effective, user-friendly library program serving blind and physically handicapped residents of the United States and U.S. citizens living abroad.

Sources

To gain a perspective on past and current Library of Congress audio activities for the blind, the following NLS publications may be examined: *Facts* 1998, the NLS fact sheet; *That All May Read: Library Service for Blind and Physically Handicapped People*; and *Talking Books: Pioneering and Beyond*, by Marilyn Majeska. Many comments in preceding paragraphs first appeared in these sources. (Full publication information may be found in the Bibliography.)

Frank Kurt Cylke
Director
National Library Service for the Blind
and Physically Handicapped

Planning for the Future

Introduction

Today the rapid pace of technological change forces all of us to alter the way we think, act, and see the world. In the domain of library service to print-handicapped people, incredible advances in computing and communications are making possible many tools and techniques to access information that were unthinkable just a few years ago. But the pace of change and the bewildering array of possible technological solutions make it difficult for agencies serving this population to know what course to chart. We at the National Library Service for the Blind and Physically Handicapped (NLS) are trying to discern the most promising path to the digital future.

Key Factors in the Design of the NLS System

Five elements drive the design of the NLS program and affect any changes that may be considered. Some elements have a legal basis, others are long-standing policies, but all are core concepts that shape our planning for the future. The elements are these:

- We offer a free library service. Just as sighted Americans can use their public library at no cost, so are NLS patrons not charged to use our

program. If playback equipment is needed to use the program, NLS supplies it, so readers can participate regardless of income.

- We are consumer-driven. NLS involves representatives of organizations serving blind people as well as our network libraries in deliberations leading to all major program decisions. We believe consumer involvement is critical to maintaining an effective and responsive library service.
- We pay no royalties to copyright holders, but in return, access to recorded books and magazines must be limited to eligible users. Currently this is accomplished by using non-standard cassettes and records.
- Our program is accessible to a wide variety of users—from mildly visually impaired to totally blind, from children to the elderly (most patrons are over sixty-five), from active readers to passive ones, from the physically able to the severely disabled/multiply handicapped.
- The program's primary focus is the recreational and informational reading needs of patrons, more than the needs of professionals and students.

Planning for Transition to a Digital System

NLS has made three assumptions in planning for the next-generation talking book system.

1. Our first assumption is that the next system will be digitally based. Not only are analog systems declining in use, but digital systems offer a number of potential advantages over analog systems:

- Improved sound quality. (This is useful, but not essential for spoken-word recordings.)
- The ability to listen to an entire book without manipulating the medium (changing discs, turning cassettes over, etc.).
- Enhanced navigational capabilities (the ability to jump from the table of contents to a chapter, skip through text one paragraph at a time instantly, choose to read or skip over footnotes, insert bookmarks for easy access to user-specified locations, etc.).
- The ability to include the full text of the book in electronic form along with the recorded version (to allow the spelling of words, keyword searches of text, etc.).

2. Our second assumption is that the current 4-track, 15/16-ips cassette system will be in use for at least another five to ten years. Eventually, we expect that a declining market for cassettes will lead to higher costs for cassettes, playback unit components, and duplication equipment and supplies. Simultaneously, the cost of digital system components will be dropping. However, we do not expect to see significant cost advantages for digital applications for at least five to ten years.

3. Our third and final assumption is that we will have to use a standard or slightly modified version of a widely used consumer product or technology to gain the cost benefits of mass production. We do not have a large enough market or sufficient research dollars to pursue a technology that is out of the mainstream.

Given these assumptions, how do we get from where we are to where we want to be? Such a conversion is a complex undertaking. When NLS

changed its delivery medium from phonograph records to cassettes, only the medium, its mailing container, and its playback device were replaced during the transition; otherwise, the system stayed the same. Now we are planning a change that will certainly affect many aspects—possibly every aspect—of our talking-book system, from recording through distribution. Very little in our current system will remain unchanged. We should not underestimate the complexity or difficulty of such an undertaking.

NLS has identified twenty tasks that will be required in the design and implementation of a next-generation talking-book system. Following is a discussion of the eleven tasks in the design phase; the nine tasks in the implementation phase will be discussed in a later section.

Design-Phase Tasks

Task 1: Define and prioritize digital talking-book (DTB) features

The starting point in the design process should be the users, who must define what they want in the next generation of talking books. NLS has begun this process in conjunction with the Canadian National Institute for the Blind (CNIB), Recording for the Blind and Dyslexic (RFB&D), the DAISY Consortium, and many other groups, working under the auspices of NISO, the National Information Standards Organization. NISO is a standards-creating body in the United States, accredited by the American National Standards Institute (ANSI) organization.

Members of the NISO committee on DTBs met first in May 1997 and have continued to meet regularly. Outcomes of these meetings will include

a standard describing the file specification for a DTB, which will ensure that agencies recording talking books in accordance with the file specification will be able to read each others' books on standards-compliant playback equipment. Other products of the NISO process will include technical reports that list and prioritize the desired features in digital talking books and talking-book players and describe the production steps necessary to implement those book features. Draft standards and technical reports are due in November 1998, with final versions following perhaps a year after that.

Task 2: Simulate a DTB using a personal computer

This task will allow NLS to test patron interest in different features and experiment with various ways of implementing them before proceeding too far into the development process. By linking easily modifiable control panels to the PC, we will also be able to test different user interfaces. In order to control risks such as rapid obsolescence and high cost, we propose to build several simulations based on different software approaches.

Task 3: Develop a computer-based life-cycle cost-analysis tool for the NLS system and candidate digital systems

We see this tool as critical to assessing the economic viability of different DTB options. Because a talking-book program is a complex service with many interrelated parts, one must look at the whole system when making cost comparisons. We plan to develop a spreadsheet-based cost model that will allow easy comparison of different approaches or combinations of approaches. Feeding into the model will be historical costs

from our current system as well as cost projections based on forecasts of long-term trends.

Task 4: When the book simulation is stable, make it available to evaluators worldwide

Feedback from evaluators will be used to produce software modifications. In addition, software must be developed to test candidate DTB systems for compliance with the NISO standard.

Task 5: Design and build a prototype digital collection-accessing and -archiving system

This archiving system is the heart of the DTB system. Once fully implemented, it will contain the entire digitized content of our talking-book holdings, approximately 140 terabytes of data. It must contain capabilities for long-term archiving as well as supplying DTB files for production, if we choose to use a physical medium, and for distribution, if we opt to disseminate audio books via a telecommunications channel. Software must also be created to convert current analog recordings into NISO-compliant digital files.

Task 6: Select an acceptable copyright protection system

As mentioned earlier, U.S. copyright law requires that NLS limit access to its materials to eligible users. Authors and publishers are concerned that our books and magazines will be disseminated to the sighted community, possibly damaging the market for commercial print or audio materials.

Once we enter the digital domain, such dissemination will become increasingly likely, so we will need to build in adequate safeguards.

Task 7: Design or select digital mastering and playback systems

Based on the results of the NISO process, NLS will design or, if a suitable system is available, select a digital recording system capable of implementing the features identified by NISO participants. While most of NLS's books are recorded in professional studios under contract, many books and magazines produced by our network libraries are done in small studios with very limited budgets. NLS will need to ensure that these studios have the tools they will need to work in the digital domain. NLS must also develop software to allow users to play a DTB based on the playback features specified in the NISO standard. This software must be compatible with multiple platforms. Finally, NLS will establish a facility for maintaining the many pieces of software developed for the DTB.

Task 8: Examine distribution methods from a systems perspective, focusing on cost and convenience

NLS will develop a variety of designs for distribution systems, including electronic systems that deliver books and magazines directly to patrons from regional or national centers as well as mail-based systems that deliver a physical medium to the patron. Cost issues will address national and regional production, playback units, storage, packaging, distribution, and other concerns. In focusing on convenience, NLS will consider ease of system operation and use by patrons, librarians, machine-lending agencies, volunteer producers, and international borrowers. Using the cost-analysis

tool described in task 3, NLS will develop a written comparison of the different distribution options, identifying the most promising candidates.

Task 9: Select players that best express the features in the NISO digital talking-book standard

Wherever feasible, NLS will use components of popular entertainment hardware to assure cost control and user acceptance. NLS will design and test user interfaces incorporating the features specified in the NISO standard.

Task 10: Build multiple prototypes

To minimize risk, NLS will build and evaluate several different prototypes and allow users to evaluate them. Subsequently, prototypes will be evaluated to assess their effect on the operations of regional libraries, machine-lending agencies, the U.S. Postal Service, manufacturers, and repair organizations.

Task 11: Design and implement prototype testing to determine life-cycle cost

NLS staff will predict the theoretical reliability of playback units and test them for actual performance, thereby identifying vulnerable components. A maintenance plan will be written, specifying which components can be repaired, which must be replaced, and the range, depth, positioning, and value of spare parts. Finally, NLS will predict the life-cycle cost of each prototype and forecast the payback point for NLS using the cost model developed in task 3.

These design-phase tasks represent only an overview of the process of moving to a digitally based talking-book system. Although the tasks are listed sequentially, many will proceed in a parallel fashion. Furthermore, these tasks address only the process of designing a DTB system. Implementation issues are addressed in a later section of this document.

Timing of Introduction of NLS Digital Talking Books

There is a great deal of work underway around the world focused on bringing digital talking books to blind readers. Some projects are already producing DTBs, while others plan to begin delivering books before the end of the decade. NLS, in contrast, does not foresee full implementation of a DTB system for five to ten years. Why is that?

Earlier, we discussed a few of the benefits DTBs will bring to readers. While several features, such as improved sound quality and decreased manipulation of the playback media, will be useful to all patrons, they are marginal improvements that by themselves do not justify a major change in technology. The most significant improvements, such as enhanced navigation and text-related features, will mostly benefit the more sophisticated users and the more complex books—that is, students reading textbooks. While some NLS users and books are in the category that will gain from the use of a digital system, most patrons and books will see only moderate improvements. For this reason, NLS is less motivated to change in the near future than are other agencies that serve primarily students.

Furthermore, we are not currently aware of a medium or a delivery system that is low enough in cost or that offers enough advantages over our current system to justify a change. As an example, let us discuss the pros and cons of a CD-ROM-based delivery system, the most viable current option.

- First, the costs of CD-ROM players and media are roughly comparable to those of our current cassette system, so there would be no significant cost savings to motivate a change. The last time we began a transition from one medium to another, in the early 1970s, our budgets were expanding every year, so it was easy to finance the parallel production of old and new playback machines. Now NLS finds itself facing several years of level or only marginally growing budgets, so we hope that whatever digital system we select will offer enough savings to at least partially finance the transition; otherwise, change will be extremely difficult.
- Second, we are concerned with the longevity of the CD-ROM technology. How long will CD-ROM be a viable medium? Already the digital video disk (DVD) is emerging. NLS has an enormous investment in machine and media inventory—over 800,000 cassette and disc players and more than 16 million copies of audio books. It would take a long time to convert that inventory. We introduced cassettes in the early 1970s, yet it was more than fifteen years before we stopped producing books on rigid disc. Nearly thirty years later, we are still transferring titles from disc to cassette format. Given the shorter and shorter life span of individual electronic technologies, we wonder how many years we could use CD-ROMs before we were

forced to begin the transition to yet another medium (especially if we don't begin to use CD-ROMs for another five years or more).

Because of our enormous inventory, we need to adopt a technology early in its life span so we can use it for the maximum number of years, and we can consider only those new technologies that promise a relatively long life span. Most of the libraries in the NLS network have volunteers or volunteer agencies that record and duplicate materials locally. They contribute a significant number of books to the collection every year and record many magazines. This entire network must be able to use any technology we adopt. So we must consider the expense and complexity for these groups as they move to the new technology, and we must ensure that such a change will be an enduring one so they do not have to replace all their equipment again after a few years.

- Third, we are very uncertain about the costs of maintaining CD-ROM players. Most of our books and machines are sent to and returned by patrons through the mail. The machines undergo considerable stress in transit. In addition, our patrons use the machines heavily, and we know that the machines are sometimes dropped, liquids are spilled on them, and in general they receive a fair amount of punishment. We wonder how well the precision elements of CD-ROM players would hold up under such conditions.

We repair about one-fifth of our inventory of machines each year—about 120,000 cassette players. The work is done by a large network of volunteer groups. NLS calculates the value of their labor at about $4.5 million annually. We are concerned that repair of sophisticated devices such as CD-ROM players would be beyond the skills of volunteers, forcing NLS to pay commercial rates for the

repairs—an expense we could not afford. Indeed, the new devices may be repairable only by replacing subassemblies, which would also be quite expensive.

Considering the uncertain life span of CD-ROM technology and its higher maintenance costs, we project the life-cycle costs of a CD-ROM-based system to be significantly higher than those of our current system. Other candidate delivery systems suffer similar drawbacks when compared to the present cassette-based system. Therefore, it seems prudent to continue using 4-track cassettes until a better alternative is identified.

Conclusion

Moving from our current system to a digital one will be a challenging and exciting process. In a recent article, Robert Lucky, vice president for applied research at Bellcore, formerly Bell Labs, highlighted the difficulties of planning during this time of rapid change. "Moore's law," he said (referring to the pattern in computer technology of constantly increasing power at a decreasing cost), "guarantees that technologies become obsolete and that economics become overturned at a rate that is incompatible with most infrastructure planning and financing." This is a frightening statement for those of us with large inventories of equipment. It forces us immediately to confront complexity and risk. Because our users are a very diverse and widely dispersed population with special needs and evolving expectations, our service is intrinsically complex. Risk is inherent in building a future based on technologies that have continuously changing capabilities and costs.

The key to handling complexity will be to separate the production process and the product into parts that are manageable, replaceable, upgradeable, and extensible. For example, the software must be modular so that it can support playback systems that evolve and users who have diverse preferences.

The key to managing risk is to support as many process and product alternatives as affordable. There is considerable uncertainty regarding which technologies will be most affordable and popular, especially when major investments are being initiated. Sponsoring several approaches through prototyping and field testing permits expensive decisions to be made with more confidence.

Certainly this will be an exciting process. As digital talking-book systems are brought into being, they will bring a great range of benefits to blind and physically handicapped readers. Many of the marvelous capabilities of the printed book will be combined with the power of computers to create a tool of unprecedented flexibility and power. We look forward to making this tool a reality.

John Cookson
Head, Engineering Section

Michael M. Moodie
Research and Development Officer

Working with the National Information Standards Organization

December 1996: Technical Standard to Be Developed for Digital Talking Book

In December 1996, NLS director Frank Kurt Cylke announced that NLS had initiated the development of a technical standard for digital talking books (DTBs) through the National Information Standards Organization (NISO). This action was the first step in designing and implementing the next-generation library-accessible medium for blind and physically handicapped individuals.

A major development for the NLS program, the NISO digital talking-book standard will address the features, file specifications, user control of playback devices, production issues, and copyright protection scheme. Parties participating will include patrons, patron-advocacy organizations, media producers (both volunteer and commercial), rights owners, equipment producers, and librarians.

NISO is the only organization accredited by the American National Standards Institute (ANSI) to develop and maintain technical standards for information services, libraries, publishers, and others involved in the business of creation, storage, preservation, sharing, accession, and dissemination of data. There are currently more than fifty American

National Standards used by such organizations, including CD-ROM Volume and File Structure (NISO/ANSI/ISO 9660), Information Retrieval (Z39.50), Information Interchange Format (Z39.2), International Standard Serial Numbers (Z39.9), and Common Command Language (Z39.58).

"At present, library access for patrons is well served by analog cassette tape technology," Cylke said. "This technology has enjoyed the acceptance and economy found in the consumer entertainment market for more than two decades. However, as digital technology gains favor in the marketplace, analog cassettes are likely to become less attractive from both the financial and consumer-preference standpoints. These two forces, economic and preferential, will ultimately converge to motivate change. This NISO standard development program will allow the change from analog to digital to be controlled and consistent with the interests of all concerned."

Developing the Standard. In announcing the project, NLS research and development officer Michael Moodie, who directs the project activities, outlined the scope and application of the DTB standard. According to Moodie, "The standard will define the file specification for a digital talking book; that is, the manner in which the various components of the DTB are coded. In addition, these sets of related guidelines will be developed: required features in a DTB, the user interface for a DTB player, and DTB production guidelines. Potential implementers include talking-book producers, manufacturers of digital and analog hardware, developers of multimedia authoring and presentation software, and media producers."

Patricia Harris, executive director of NISO, announced that NLS, as the sponsoring organization, will chair the standards-development committee. Representatives will be invited from the American Council of the Blind, Association for Education and Rehabilitation of the Blind and Visually Impaired, American Foundation for the Blind, American Printing House for the Blind, Blinded Veterans Association, National Federation of the Blind, and Recording for the Blind and Dyslexic. Other organizations from both the public and private sectors will be included, along with representatives of engineering and library interests.

Howard White, editor of the American Library Association's *Library Technology Reports,* will serve as liaison between NISO and the NLS-sponsored effort.

Commenting on the complexity of the undertaking, John Cookson, head of the NLS Engineering Section, said, "The impact on users moving from existing practices to the new digital standard must range from 'virtually transparent' (products seemingly the same to the user but with technical improvements) to 'profound' (products with a range of options for the more technologically sophisticated patron).

"This impact statement focuses on the blind and physically handicapped patron," said Cookson. "However, there is an infrastructure of 'users' who support and implement the library system. This wider community includes librarians; producers of talking books and magazines—both commercial and volunteer; equipment manufacturers; and software developers. Each of these groups will be affected differently

by the change to a digital standard. For example, audio studios may continue to narrate into conventional analog equipment, but their product would become usable only by processing through digital encoding software that is not found in today's production stream," Cookson concluded.

Implementing the Standard. Wells B. Kormann, chief of the NLS Materials Development Division, also commented on the value and potential implementation of the project: "The entire user community will be motivated to use this standard. The existing system is analog cassette tape, while the standard will define a system that will be digitally based but not restricted to any particular distribution media or implementation. Because of this fundamental incompatibility, the change will require a transition period in which both systems are in use. Time frames for introduction of new equipment depend on the commercial development and availability of adaptable consumer electronic hardware and software products."

According to Kormann, "Anticipating an additional ten years of acceptable and economical use for cassette tapes means that the standard must be finished within five years to allow for a five-year transition period."

May 1997: NISO Process Begins for Digital Talking Book

The NISO Talking Book Standards committee held its first meeting in May 1997 to begin the process of designing a DTB system. This two-day standards development meeting was hosted by NLS. More than two dozen

individuals from companies, libraries, and organizations that serve and represent blind and physically handicapped persons attended. The representatives contributed expertise in the areas of consumer electronics, library service, engineering, audio book production, computers, standards development, international compatibility and design, information access, and adaptive technology.

Rosemary Kavanagh, executive director of the Canadian National Institute for the Blind's Library, said of the meeting, "The spirit of cooperation and workmanship which prevailed was excellent and commendable." She added, "I remain much more hopeful that we will see standards that not only allow us to exchange books and materials but also to buy shelf-ready items from talking-book producers the world over."

Features Identified. Committee members identified and prioritized more than one hundred features for a future DTB system. These features describe the needs of blind and physically handicapped persons who will be using the system. "By focusing on user requirements rather than specific hardware or media, we can develop a standard that will keep pace with the rapid changes in technology," said Michael Moodie, NLS research and development officer, who is coordinating the committee's activities.

In order to define features for a system that does not yet exist, committee participants created an exhaustive list of characteristics for every aspect of the system. These included audio quality and controls, user interface, power sources and requirements, media navigation, help functions, copyright protection, multilingual functions, text display

capabilities, and administrative considerations. The deliberations resulted in a description of a digital book that would incorporate text, voice, and other data with varying levels of user control, functionality, and data richness available to the reader.

The committee proposed three levels of audio playback devices: a basic six-button, portable, audio-only model; an advanced stand-alone model with more capabilities for students and professionals; and a computer-linked software version that would be connected to a personal computer and allow for advanced text navigation. After defining both the features and the levels of complexity, the participants assigned each feature to the appropriate device and determined whether the features were essential, highly desirable, or useful. For example, start and stop controls would be essential features on all three machines, while the ability to add notes or to highlight text would not be present in the basic machine, but would be highly desirable in the advanced unit and essential in the computer-linked version.

Working Groups Formed. The committee's next step was to form working groups to examine the many specialized areas of concern. One group will use the prioritized list of features to create an organized document with expanded descriptions and examples for review by the full committee. Another group will focus on the DTB file format. Digital file format guidelines and specifications are undergoing rapid developments and changes because of the explosive growth of World Wide Web (Internet) publishing. A third group will research user interface—specifically matters such as design of controls, tactile and visual markings,

and feedback to users. Copyright protection in the digital domain became a fourth working group's area of research. This issue is currently receiving much attention in the digital publishing community.

The groups presented their findings at the committee's next meeting in September 1997. Under NISO guidelines, a first draft of the standard is due within eighteen months of the first meeting, by November 1998. A final standard is expected in two to four years.

September 1997: NISO Group Moves Ahead

Experts in the fields of digital technology, librarianship, service to blind and physically handicapped persons, and other related fields met at NLS in September 1997 to continue the process of developing a standard for a DTB system. Under the auspices of NISO, the Digital Talking Book Standards Committee of more than two dozen participants shared ideas and sharpened their focus to keep pace with fast-moving developments in technology.

At its first meeting in May 1997, the committee established working groups. Each working group was asked to concentrate on a particular area: expanded descriptions for the features list, file format for digital talking books, the user interface, and copyright issues.

At the second meeting of the full committee, in September 1997, members reported the findings of the working groups and continued discussion of specific features for a future DTB system. They determined

that the bulk of the group's activities for the near future should concentrate on defining requirements for the digital talking book itself, rather than the playback device. The committee agreed that the central task was to develop a file specification for the content of the DTB.

File Specification. The file specification will describe how the audio and textual material of a digital talking book should be coded; that is, what codes should be used for given functions. For example, a digital book should be structured so that a blind patron listening to the table of contents could jump immediately to a desired chapter. The file specifications would describe what codes an audio book producer would insert in the recording to make that jump possible.

Mark Hakkinen, representing The Productivity Works, Inc., and chair of the file specification working group, reported significant activity in this area among several organizations. He explained that standards and protocols written for the Internet are "likely to play some role in the delivery of DTBs." The World Wide Web Consortium (W3C) is facilitating the creation of specifications that allow for the delivery of audio and text content through the Internet. W3C is an international industry consortium that develops common protocols for the evolution of the World Wide Web. In April 1997, the W3C launched the Web Accessibility Initiative to promote Web functionality for people with disabilities. "A major premise of the Web happens to be open, standards-based protocols and languages," said Hakkinen.

He also noted that the DAISY Consortium, a multinational effort originating in Sweden to design a DTB system, made a decision early in 1997 to move to an open, standard file format. George Kerscher, of Recording for the Blind and Dyslexic, and Thomas Christensen, of the Danish National Library for the Blind, represent the DAISY Consortium on the NISO DTB Standards Committee. Their input in both efforts will promote an open exchange of information and decrease duplication of effort.

Copyright Protection. The group examining copyright protection submitted its findings in the form of a special presentation by Mary Levering, associate register for national copyright programs, Library of Congress, and former chief of the NLS Network Division. Levering gave a brief history of U.S. copyright law, explaining its roots in the Constitution and its use in the protection of creative expression.

She noted that libraries for the blind use special measures, such as producing talking books in a nonstandard 4-track cassette format and ensuring that users meet eligibility standards, to curb the illegal redistribution of copyrighted works. These protections "help maintain a balance between the rights of copyright holders and the rights of users of those works," according to Levering.

In the digital arena, the retransmission of copyrighted works is a matter of great concern to copyright holders because of the ease of making an almost endless number of perfect copies of an original work. Levering outlined the activities of international organizations, such as the World

Intellectual Property Organization, to deal with digital issues. She explained that these endeavors seek "to ensure that laws and practice adapt to protect and support the wonderful creative output without cutting it off at the limbs."

Levering explained that some of the technological controls under development include digital object identification, watermarking, data encryption, and electronic signatures for images, written text, and sound recordings.

Action Items Planned. The committee established two new working groups. The first new group will assemble a comprehensive list of navigation and manipulation features for an advanced computer-based audio playback device. This compilation will contain the full range of features desirable on a DTB. The second new group will craft digital production guidelines for audio-book producers. The file specification group will continue its work to create or identify an appropriate file format, ensuring that the file structure is capable of supporting all the features identified by the group working in that area. Where possible, members will try to match existing specifications so as not to duplicate ongoing work. The working groups will meet separately before the next full committee meeting.

March 1998: Working Groups Give Reports

As agreed at the September 1997 meeting of the Digital Talking Book Standards Committee, three working group meetings were held in January

1998. The committee, working under the auspices of the National Information Standards Organization (NISO) is developing a standard for a digital talking-book (DTB) system. The first meeting, held on January 9 at the National Center for the Blind in Baltimore, brought together members of the working group on text navigation features. This group was charged with developing a comprehensive list of features that would be required by the most advanced digital talking-book user reading the most complex DTB. Their draft report described nearly fifty features, including such capabilities as moving through the book a word, sentence, paragraph, or page at a time; jumping directly from the table of contents or index to an item listed there; placing bookmarks at important points throughout the document to which a user can quickly return; and searching for a specified word or phrase.

On January 14, 1998, the working group on production guidelines met at NLS in Washington. Basing their discussions on the draft report from the working group on text navigation features, members looked at each of the features described and analyzed its impact on the production of a DTB. Approximately half the features listed would require some special intervention during production and half could be implemented solely through functions built into the playback device. The working group drafted a report of its discussions, annotating the report of the navigation features group with production-related commentary.

On January 15, 1998, the third working group met at NLS to address issues related to the file specification. This group also followed the outline of the report from the working group on navigation features, assessing how

the file specification should be structured in order to implement each feature listed. The general consensus of the group was that the file structure of a DTB would consist of three major parts: an audio file, which could be encoded in any of several standard audio codecs (compression/ decompression algorithms that allow enormous audio files to be greatly compressed); a text file (necessary for word spelling and text searches) with tags from a descriptive markup language inserted—probably HTML 4.0 (Hypertext Markup Language); and a linking file that synchronizes the audio and text files, probably written in SMIL (Synchronized Multimedia Integration Language). Discussion revealed that HTML alone did not have sufficient elements to handle all the complexities of digital talking books and that additional tools such as Cascading Style Sheets or XML (Extensible Markup Language) would be needed.

In addition to the three major components just described, the group also recognized the need for a "Book Information File" that would hold summary information about the book and a "Navigation Center" that would include every significant text element in the book, from dust jacket information, copyright statement, and foreword, through chapters, sections, and subsections, whether or not these items were listed in the table of contents. The navigation center, as its name implies, would be the primary tool used by readers to move through a document.

After individually reviewing the working groups' reports, the full committee met on March 15 and 16, 1998, in Los Angeles. Members first discussed the report on navigation features. A key area of focus was the relationship between the table of contents found in the print document and

the "navigation center" discussed above. Members were concerned that if both included a full range of navigation features and options, yet were different (the navigation center would normally contain much more detail than the print table of contents), users would be confused by the differences. The group recommended that the print table of contents contain no navigation options other than hypertext links to the items listed, while the navigation center would be very flexible and could be accessed in a wide variety of ways. The committee asked that the working group incorporate the committee's recommended changes and then make the document widely available to consumers and other interested parties for comment.

Three members gave demonstrations of DTB hardware and software prototypes. Gilles Pepin of VisuAide, Inc., demonstrated "Victor," a CD-ROM-based DTB player that incorporates nearly all of the functions listed in the navigation features report. He also showed the group a PC-based "time-scale modification program" that altered the speed of a portion of narration over a wide range without changing the pitch of the narrator's voice. Dennis DeVendra of Recording for the Blind and Dyslexic played a prototype DTB on a laptop computer, illustrating how a user could move instantly from one part of a DTB to another and how the text and audio segments were synchronized at the sentence level, so that a sentence would be highlighted on the screen while the audio portion played. He explained that the two pieces of the DTB had been synchronized by a special program that automatically matched a sentence in the text file with the corresponding sentence in the audio file. Automatic word-level synchronization also appears quite feasible. Mark Hakkinen of The

Productivity Works, Inc., also demonstrated a digital talking book, this one produced using SMIL to link the text and audio files. All three demonstrations revealed the great potential offered by digital talking books for ease of use, enhanced access to information, and fast, flexible navigation through a document.

Mark Hakkinen, chair of the file specification working group, led a discussion on developments in each of the three areas of the file structure: text, audio, and linking.

Text. The committee continued the discussion begun in the January file specification meeting regarding the choice of markup language for the text file. The strengths of HTML 4.0 are that it is widely used and understood and that many authoring tools are currently available for it. However, it would require the use of supplementary tools to handle all of the complexities of a DTB. In contrast, XML appears to have the tools and flexibility needed to implement DTBs, but is very new and thus little known. It was agreed that XML represented the more promising approach but that further evolution of markup languages like XML and HTML was inevitable. Rather than endorse one at this point in the standards development process, the committee chose to focus instead on the underlying requirements of text markup. It was agreed that the standard would identify all of the semantic elements to be used in digital talking books and would also include a sample "Document Type Definition" (DTD) for XML. The DTD shows how the elements defined in the standard are identified and used in the specific markup language.

A new working group was created to develop the markup-language specification. Called the MarkUp Specification Team ("MUST"), it will be chaired by George Kerscher of the DAISY Consortium and include ten other committee members.

Audio. Lloyd Rasmussen of NLS presented an overview of the current status of audio codecs. He described the different approaches the codecs take, each with its own strengths and weaknesses. His conclusion was that any of several widely used codecs can provide high-quality sound and significant savings in storage requirements.

Linking. The Synchronized Multimedia Integration Language (SMIL) continues to progress toward standard status. Since January, major software firms interested in utilizing SMIL performed an interoperability test, successfully demonstrating test versions on each others' playback systems. It is expected to receive "recommendation" status (equivalent in this arena to an approved standard) by May 1998. Several test DTB fragments have been developed and it was recommended that committee members' organizations do sample implementations of their own to test SMIL further.

Michael Gosse of the National Federation of the Blind presented a proposal for synchronizing the text and audio files at the word level, using a separate binary file to indicate the precise time at which each word begins in the audio track. When a user identifies a specific word in the audio file, the playback device would calculate its position (e.g., tenth word in the paragraph) and locate the word at the same position in the corresponding

paragraph in the text file. The committee discussed several mechanisms for limiting the size of the binary file so that it would not significantly impact the overall size of the DTB.

Copyright. During a discussion of copyright issues, Mary-Frances Laughton of Industry Canada reported that the Association of Canadian Publishers (ACP) has been meeting with Canadian producers of alternate format materials to discuss methods of ensuring that only eligible populations have access to such materials. The ACP initiated the project but was impressed with the commitment of alternate format producers, as demonstrated by current practice, to limiting access to copyrighted materials. Laughton will distribute the report to committee members when it is released in May.

Action Planned. The first working group will incorporate committee recommendations into its navigation features document and distribute it widely for comment. The file specification working group will track and report on developments in SMIL and markup languages. The recently formed fourth working group will meet at least once to begin development of the markup-language specification. The full committee will meet next in October.

Participating Agencies

American Council of the Blind
American Foundation for the Blind
American Printing House for the Blind

Association for Education and Rehabilitation of the Blind and Visually Impaired

Association of Specialized and Cooperative Library Agencies

Blinded Veterans Association

Canadian National Institute for the Blind

The Hadley School for the Blind

Industry Canada, Assistive Devices Industry Office

LaBarge Electronics

NCR Corporation

National Federation of the Blind

National Institute of Standards and Technology

National Information Standards Organization

National Library Service for the Blind and Physically Handicapped

The Productivity Works, Inc.

Recording for the Blind and Dyslexic

Telex Communications, Inc.

TRACE Research and Development Center, University of Wisconsin

VisuAide, Inc.

World Blind Union

Robert E. Fistick
Head, Publications and Media Section

Vicki Fitzpatrick
Senior Writer-Editor, Publications and Media Section

George Thuronyi
Writer-Editor, Publications and Media Section

Digital Talking Book Technology: Activity Planning

While NISO continues the development of a DTB standard, NLS will test digital methods and build expertise on topics directly relating to DTB features. This research will involve "hands-on" testing of relevant software, possibly including some patron evaluators. Examples of testing activities are summarized below.

Test and report on methods to vary the playback rate while maintaining original pitch

This process allows users to speed up or slow down talking books without the voice becoming very high or low in pitch. Several algorithms will be considered, such as Cool Edit (audio editing software reportedly used in the European Digibook project), KBX96000 (real-time controlled hardware under development at Discrete Time Systems Ltd.), and a software signal processor (Entropic's system, which is restricted to NT and UNIX hosts). Effective real-time control is needed for patron evaluation, but it is not yet available. The promised but as yet unrealized MPEG4 standard may also be of interest here. An ideal test system would allow a patron evaluator to change playback to any rate between half speed and triple speed, yet maintain pitch and intelligibility.

Test and report on state-of-the-art audio coding and decoding algorithms for efficient storage of spoken audio

For economy and acceptance, emphasis will be on algorithms most likely to become standards in the consumer entertainment market. Examples of coder/decoder algorithms include MPEG and AC3, systems that permit ten-to-one data reduction with no perceptible loss of fidelity. Although it poses significant programming and control problems, integration of decoders into multimedia presentation software is essential.

Test and report on alignment of text with audio to provide efficient text search of spoken audio

Two programs are reported to do this: one by IBM is embedded in a large workstation system; the other, from Entropic, runs on an NT or UNIX host. Both algorithms are consistent with file structures discussed at the first NISO meeting. This technology promises to automate indexing of spoken audio by creating a file that links it to searchable text.

Test and report on alternative controls of multimedia software

One possible approach is to experiment with simple programmable remote controls. This strategy allows development of user controls, particularly verbal feedback, independent of playback technology.

Test and report on state-of-the-art text-to-speech algorithms

One example is Microsoft's Whistler synthesizer, which is said to be "natural." (Samples definitely sound less robotic than the standard

DECtalk.) Since the algorithm is available only in C++ source code, we will need a compiler to support a suitable evaluation.

Test and report on digital recording, editing, and duplication methods using digital audio tape (DAT) and direct-to-disk recording

We have recorded one book on DAT in the NLS studios, and we are examining specifications and performance reports on direct-to-disk systems, such as those offered by Telex and Otari.

Test and report on the use of off-the-shelf multimedia authoring and presentation software for representing DTB segments

This software is interesting because of its widespread commercial use, inclusion of user controls, and variety of data types supported. Examples include Macromedia's Director and Asymetrix's Toolbook.

Evaluate products from Plextor, the DAISY Consortium, Recording for the Blind and Dyslexic, and other sources as they become available

John Cookson
Head, Engineering Section

Twenty Steps to Next-Generation NLS Technology

Introduction

In designing and implementing next-generation technology for the National Library Service for the Blind and Physically Handicapped, we must address the following questions.

1. When do we change?
   - When a new system becomes cheaper than the current cassette system.
2. What do we change to?
   - A standard based on what patrons and providers tell us.
   - A digital system that we thoroughly test using computer software.
3. How will we know it's cheaper?
   - We look at every cost in a digital system versus every cost in our current cassette system.

Background

This is a summary of steps that must be taken to design and implement next-generation NLS technology. Two factors motivate change: cost and patron expectations. As digital methods supplant analog methods in the consumer entertainment market, older technology becomes obsolete and

expensive. Furthermore, features available only with digital technology are likely to be in demand by patrons. Future system access will likely be via two routes: electronic communication of book data and postal delivery of media and players. (In this section, "digital talking book" [DTB] and "book data" include magazines.)

In this summary, we focus on replacing about 672,000 cassette tape players with digital players. This move involves a major cost risk. Before replacing all the tape players, we plan to develop and provide software-only players and accompanying software. The book data (the media) are likely to be distributed through regional centers, which will, in turn, distribute them by mail or provide direct electronic connections to patrons.

To the extent that a list format allows, the steps are presented in order of dependency, which is roughly chronological. Many activities, however, are done concurrently. While the introduction above is framed in deceptively simple terms, scanning the outline below will help the reader realize how complex the process really is. The key to success is managing risk at every step by pursuing multiple options.

Design Phase

The design phase, discussed in detail in an earlier section, comprises eleven steps and will require about five years. The hallmarks of the design phase will be a system approach, low cost, low risk, and high visibility.

1. Define and prioritize digital talking-book (DTB) features.

   A. Propose mandatory, desirable, and specialized categories.
   B. Use National Information Standards Organization (NISO) process involving community of users, librarians, advocacy groups, manufacturers, producers, international borrowers, and lenders.

2. Simulate a DTB using a personal computer.

   A. Test feasibility and patron interest in features.
   B. Develop and refine user control preferences.
   C. For risk control, build several simulations based on different software approaches.

3. Develop a computer-based cost-analysis tool for the NLS system and candidate digital systems.

   A. Build a historical cost data set.
   B. Examine and forecast long-term trends.
   C. Estimate critical decision points.
   D. Determine cost range within which DTB adoption is feasible.

4. When the book simulation is stable, make it available to evaluators worldwide.

   A. With NISO approval, make changes suggested by evaluators.
   B. Develop software to test and certify NISO compliance of DTBs.

5. Design and build a prototype digital collection-accessing and -archiving system.

   A. Write software to convert familiar NLS analog products to NISO-compliant digital files; select titles and convert them to NISO format.
   B. While strictly limiting the number of subscribers, open the system to remote access for further evaluation as a model for regional access.

6. Select an acceptable copyright protection system.

   A. Propose the use of a system accepted for consumer entertainment such as the Content Scrambling System for digital video discs.

B. If A is not acceptable, consult publishers, and design and propose a minimum-cost acceptable system.
C. Obtain NISO concurrence; test real-time decoding.

7. Develop DTB computer software for production and presentation.

A. Build authoring tools for DTB production by both volunteers and professionals.
B. Begin digital mastering with concurrent text linking in NISO format.
C. Compare concurrent audio/text linking with software linking.
D. Build modular playback software for multiple platforms.
E. Establish DTB software facility for maintenance configuration control.

8. Examine distribution methods from a systems perspective, focusing on cost and convenience.

A. Design mixed electronic and media-delivery systems such as
- Electronic delivery direct to patrons from regional centers and, for special cases, from a national center.
- Postal delivery of media made at regional centers and, for special cases, of media made at a national center.

B. When considering costs, include regional production, storage, and packaging.
C. When considering convenience, include ease of system operation and use by patrons, librarians, machine-lending agencies (MLAs), volunteer producers, and international borrowers.
D. Write options paper expressing technological choices in a decision matrix; use cost-analysis tool developed in step 3.

9. Select players that best express the features in the NISO digital talking-book standard.

A. For cost control and acceptance, use components of popular entertainment hardware where feasible.
B. Design and test user interfaces required for NISO DTB compliance.

10. Build multiple prototypes.

A. Implement an evaluation plan to find user preference.

B. Implement an evaluation plan to assess effects on regional libraries, MLAs, postal delivery, manufacturers, duplicators, contract studios, volunteer studios, and repair organizations.

11. Design and implement prototype testing to determine life-cycle cost.

A. Predict theoretical reliability (mean time between failures) and test for actual performance; identify vulnerable components.
B. Develop a maintenance plan that specifies
- Which components can be repaired.
- Which components must be replaced.
- Range, depth, positioning, and value of spare parts.

C. Predict life-cycle cost (dollars per patron, per year) and forecast the pay-back point using the cost model developed in step 3.

Implementation Phase

The implementation phase, discussed in detail in the next section, comprises nine steps and will require about five years. This phase will be characterized by high risk, high cost, and high visibility.

12. Narrow player and media choices by selection via decision matrix.

A. For the chosen players, refine cost estimates and package design, storage, and maintenance; get postal approval for packaging.
B. For the chosen media, refine cost estimates and package design and storage; get postal approval for packaging.
C. Consider safety, pest control, and pilfering.

13. Design and test catalog access and ordering system.

A. Consider patron privacy and library personnel resources.
B. Automate catalog update from NLS.

14. Design and test circulation- and inventory-management software for libraries, MLAs, and NLS.

A. Build in self-identification of players (for audit purposes).
B. Build in statistical reporting that ensures patron privacy.

15. Design and test software for international lending.

    A. Ensure that international copyright requirements are met.
    B. Design and test software for conversion of books to international format.
    C. Test electronic and media delivery methods.

16. Evaluate player manufacturers and communications providers.

    A. Qualify manufacturers with sufficient and available production capacity.
    B. Establish methods for getting the best value in communications.
    C. Ensure that all government procurement regulations are satisfied.
    D. Award manufacturing and communications contracts.

17. Operate digital and cassette systems simultaneously.

    A. Scale back production of cassette book machines.
    B. Produce 1,000 to 5,000 digital players for field evaluation.
    C. Further evaluate electronic delivery, at least to regional centers.

18. Begin full-scale production and deployment of digital equipment.

    A. Set up QA process at manufacturer(s).
    B. Set up QA process at warranty repair and volunteer repair facilities.
    C. Cease production of cassette players; continue repair for ten years.

19. Establish a method for continuous patron evaluation of the new system.

    A. Update player software in response to patron preferences and library support needs.
    B. Establish maintenance process for player and software documentation; include configuration control.

20. Establish a method for continuous evaluation of infrastructure.

    A. Include librarians, MLAs, international borrowers, and lenders.
    B. Include configuration control.

John Cookson
Head, Engineering Section

Nine Tasks to Implement the Use of Digital Talking Books

There are nine essential tasks in the implementation phase of building a digital talking-book machine, beyond the eleven design-phase tasks already discussed. These are numbered as tasks 12 through 20 in the previous article and are described in greater detail below.

Task 12: Narrow the player and the media choices

This task is to narrow the player and media choices using a problem-solving decision matrix, a mathematical model used to help select one of a range of possibilities. This model will help NLS decision makers determine the best technology available. A detailed description of this process is provided in Appendix I.

In the meantime, we will consider refining the cost estimates and designs of packaging, storage, and maintenance for the alternatives. Life-cycle costs will play an important role in determining how much logistics support the program can afford. We will have to look at the impact on the regional libraries and machine-lending agencies (MLAs) at the state level and on NLS and the U.S. Postal Service at the federal level. Both budgets will be affected by the system selected, so input must be obtained from both sectors. NLS will be directly responsible for obtaining postal concurrence for packaging. We will also have to consider safety, pest

control, and pilfering issues. Such concerns need to be addressed early in the DTB system development.

Task 13: Design and test a catalog-access and ordering system

In this task, NLS will consider patron privacy issues and network library personnel resources. To assure proper design, NLS will need to base the system on what currently exists in the field to avoid integration problems. It is very difficult to integrate two new systems, as requirements and definitions can sometimes change in both. Automating the catalog update from NLS also will have to be examined. We must control this update in order to ensure that no anomalies are introduced into the system.

Task 14: Design and test circulation- and inventory-management software for libraries, MLAs, and NLS

As part of this task, we will examine incorporating a means of self-identification in players for audit purposes. Players also should have built-in test circuitry to help repair personnel determine the types of software errors that occur. In addition, we will have to build statistical reporting into the system to ensure patron privacy. Such reporting would be similar to that currently being used, but with modifications to handle digital statistics.

Task 15: Design and test software for international lending

As part of this task, we will have to ensure that international copyright requirements are met.

Task 16: Evaluate the players and media provided by manufacturers and communications providers

Upon completion of software design and testing, a full-scale open competition will be conducted using the federal acquisition regulations and procurement processes. The Library of Congress contracting staff will establish formal cost and technical teams to review the proposals to determine which system would be best for the government in terms of both price and technical quality. Procurement normally takes at least nine months. For a detailed description of the process, see Appendix II.

Task 17: Operate parallel digital and cassette systems simultaneously

NLS will begin scaling back the production of cassette-book machines to have funding available to introduce the new technology. Initially NLS will produce 1,000 to 5,000 digital players for field evaluation to ensure that they satisfy the consumers. Units that fail to meet specifications will be returned for warranty repair. In addition, if design flaws are reported, NLS will convene an Engineering Change Control Board meeting. If the Library of Congress is at fault, we will pay for repairs and units already in the field will be recalled. However, if it is found that the contractor failed to follow specifications, the contractor will be required to remedy the situation at no cost to the government.

Task 18: Begin full-scale production and deployment of digital equipment

In this step, NLS will set up the quality assurance process at the manufacturer(s) facility. Initially, two design samples will be provided for review, then two hundred production samples will be examined by NLS.

NLS representatives will travel to the manufacturer twice a month until the line is solidly established and the inspection visits can be cut back to monthly. NLS will also need to work with the repair volunteers (the Elfuns and the Telephone Pioneers of America) to help them understand the new system and to develop new repair procedures. In addition, a warranty repair process will need to be established with the manufacturers, in coordination with the libraries. Eventually, NLS will cease producing the cassette players but will continue to repair them for ten years or for as long as parts are available, whichever occurs first.

Task 19: Establish a method for continuous patron evaluation of the new system

The patron-evaluation method will include ways to update the software in response to patron preferences and library support needs. Development might be done by the NLS National Audio Equipment Advisory Committee, or perhaps by a separate committee, as long as accurate and updated information can be ensured. NLS will also establish a maintenance process for player and software documentation, including configuration control.

Task 20: Establish a method for continuous evaluation of the system

This method will include input from the libraries, and Machine Lending Agencies. It will also include configuration control. The continuous evaluation could be done in conjunction with the libraries' regional conferences.

Wells B. Kormann
Chief, Materials Development Division

Consumer Involvement: Essential to Planning for the Future

Consumerism in the general marketplace is undergoing profound changes. Consumer expectations are increasing dramatically for everything from household products to secondary education. Awareness of the changing expectations of consumers should be part of any consumer-oriented development plan. Without careful attention to the expressed and unexpressed expectations of consumers, unexpected queries and protests can stymie the progress of even the most technologically sound plan.

Like the general population, members of the eligible blind and physically handicapped population vary greatly in age, intellectual level, vocational pursuits, and, of course, technological sophistication. These and many other factors will have a significant effect on their acceptance of and adaptability to a new format for their reading material.

Differences in the technological sophistication of blind and physically handicapped consumers will not only affect the manner in which consumers adapt to new things, it will also affect their notions regarding change in general. Why do things need to change? Why can't libraries for blind and physically handicapped individuals continue to produce talking books on cassette? A reasonable explanation of the need for change will be necessary for a large portion of the population. Rationales such as the increasing cost of maintaining the current technology, its continued

viability in a changing consumer marketplace, and the potential for increased usability and flexibility of a new medium can help to allay fears and ensure cooperation.

At the other end of this spectrum, some consumers express considerable interest in the transition to a digital format and often wish to know why the change wasn't made sooner.

Consumer Involvement

An often perplexing notion for product developers is how to get consumer feedback on a product that doesn't exist. The fact that no piece of the proposed machinery can be placed in the hands of a blind or handicapped person should not be a deterrent to involving consumers in the transition. Many aspects of the transition to a digital format lend themselves well to consumer involvement, even at the earliest stages.

As of 1998, efforts to bring together a wide variety of expertise from organizations such as the NLS Technology Assessment and Research Program (TARP) and NISO have involved consumers. Representatives from consumer organizations, patrons of regional libraries, and network library staff have participated in an active, meaningful way. These consumers have provided detailed input on possible features such as indexing methods and search functions.

Happily, a growing portion of the consumer population is familiar with the forms and features of current consumer electronic equipment—

compact-disc players, digital message recorders, and digital answering machines. In addition, in the United States, Australia, and New Zealand, news services—even daily newspapers—are carried over the telephone in digital format. Such products and services demonstrate the vast range of possibilities to the less technologically sophisticated members of the population.

It is possible to involve even the most unsophisticated consumer at every stage in the process: the conceptual stage, software modeling (audio quality testing, etc.), and hardware mock-ups. At a recent meeting of the NLS National Audio Equipment Advisory Committee, consumers tested the quality of various levels of audio compression. Even though there was no actual product for them to examine, it was possible to obtain their feedback on the relative clarity of audio samples, thus guiding the way toward decisions about compression ratios for file formats, storage media, and so on.

When attempting to communicate some of the conceptual notions about digital design, it may be helpful to have a metaphor in mind; for example, "The goal of the form and features of this model is to match as closely as possible the use of a print book." The developer can then communicate the metaphor to targeted consumers as a framework for conceptualization and discussion.

Needs Assessment

For some aspects of the transition to a digital format, standard needs-assessment activities can be very useful in making sure that a representative cross-section of consumers is involved. Of the several methodologies typically used in a needs assessment, the one chosen must be appropriate to the type of needs being assessed and to the target group of consumers.

To determine needs that relate to talking books and how a digital format may be configured, a combination of several methodologies will likely yield the best results. Four common methods for assessing needs are (1) secondary use of data, (2) key informants, (3) community forum, and (4) survey.

Secondary Use of Data. In this method, inferences about consumer needs are derived from data collected by different groups for other purposes—as part of a national census, by health-care institutions, by large organizations serving the same population, or even from the organization's own user statistics. Data used in this approach include social and demographic indicators such as age, educational level, employment data, and income level; service statistics and use patterns; and epidemiological data. The analysis of trends for factors like age and educational level can have wide-ranging implications for the talking-book format of the future. It is important to determine whether advanced features—which may take a disproportionate amount of time and expense to develop—will be used by only a few people pursuing advanced academic degrees, or whether such features will be more and more in demand by a wider segment of the

population with an increasing educational level. While advanced features may be costly to develop, such efforts may offset the cost of multiple activities currently underway to meet the needs of both recreational and educational/professional users.

Care must be taken, however, to ensure that data gathered and trends observed truly reflect the blind and physically handicapped population. For example, the population in general may be getting older, but is the blind population getting older at the same rate, at a faster rate, or at a slower rate?

The advantages of gathering information through secondary analysis of existing data are that the data are readily available at minimal cost and on a wide variety of characteristics, and information can be gathered on unserved portions of the population. Some disadvantages of this method are that the data reflect only information individuals have been willing to share with an institution or government; the data tend to be descriptive; many statistics will be estimates; and the data do not reveal the individual values and beliefs underlying current trends.

Key Informants. Individuals typically invited to serve as key informants are persons from other service agencies and educational institutions, along with consumer-group leaders and representatives who have specific knowledge of the needs of the group. Key informants can be interviewed individually or assembled in one or a series of meetings.

This method is frequently used for program planning purposes by libraries for blind and physically handicapped readers. Consultants are

invited to review or gather information and make recommendations—for example, the development of strategies for meeting the reading needs of blind and physically handicapped Native Americans. This method also involves the ongoing use of advisory committees of a few individuals selected for their expertise or representativeness.

As an adjunct to this method of needs assessment, developers should seek opportunities to see representative consumers in the context in which they use the service. Such encounters can be arranged by a library or consumer organization that can identify representative individuals who would welcome such visits. The developer then simply goes to the consumer's listening environment, typically a private home, observes the details of where and how the service is used, and asks some open-ended questions about the medium. This is not a data-gathering effort; rather, it is an attempt to get some first-hand impressions of what consumers are like and what characterizes the listening environment. It can reduce "ivory tower" misperceptions and give developers some sense of consumer expectations and priorities.

Another valuable experience is participation in sessions where prospective consumers are introduced to the library service and the related equipment for the first time, possibly during training for persons who have recently become blind. Participation might consist of simply observing or might include helping with instruction and equipment presentation. Through this experience, the developer can get a personal feel for problems and opportunities associated with a blind person's first encounter with an unfamiliar device. Again, this is not a scientific study but a personal

encounter essential for a developer who has never met a consumer. The background and context it provides can guide the developer's thinking.

The advantages of the key-informant method are that it provides a good opportunity for in-depth study, it can be performed in a short time, and it is useful for reaching target groups who are isolated by language or culture. Its disadvantages are that the informing individual may not be representative of the entire group, the method can place undue emphasis on population segments, and it can result in conflicting statements that are difficult to reconcile.

Community Forum. The community forum uses the perceptions and experiences of individuals invited to the forum to identify and assess the varied needs of disparate groups in the consumer community. Ideally, all segments of the consumer population are represented. This method, when applied in its general form, is least likely to give usable results and is most often reserved for the consideration of very general issues. A community forum may, however, include some kind of brainstorming activity to stimulate the flow of creative ideas. Such brainstorming may have a wider application for involving consumers in the transition process, especially at the earliest stages.

The advantages of community forums include the following: they are useful when the community is relatively small or can be divided into manageable units, they can be planned and executed very quickly, and they clearly demonstrate to the members of the entire population that the organization is concerned about their needs. The disadvantages are that

they assume that individuals can articulate their needs, and that some segments of the population may not be able to attend meetings because of age, disability, transportation problems, and the like.

Survey. The survey method assesses needs by collecting data from the entire population or from a selected portion of the population. The most common methods are in-person interviews, telephone surveys, and questionnaires. However, current program users cannot shed light on the needs of the unserved population, so care must be taken to use data gathered from this group only to plan services for current program users.

The advantages of the survey method are that each respondent has an equal chance of being heard, it is the most scientifically reliable and valid method, and it provides information about an individual's perception of his or her own needs. The disadvantages of this method are that it is the most time-consuming and expensive technique, only actual respondents' input is represented, people can respond with only what they know is possible, and many complexities exist in surveying a blind or visually impaired population.

A Note about the User Interface of a Digital Talking-Book Player

One especially thorny aspect of the development of a digital format is the user interface. How will the user interact with the finished product? With technology changing at a rapid rate, answers to this question are probably just vague descriptions of the ultimate possibilities. However, the

user interface between persons with disabilities and a wide variety of consumer products has become a popular area of academic research, with application to such devices as information kiosks; automatic teller machines; set-top boxes; and other touchscreen, on-screen, and telephone-based services. Efforts to stay abreast of these activities continue so that the end user will benefit from the most consistent and seamless interface possible.

As prototype talking-book equipment and delivery systems are developed, multi-faceted consumer testing programs will be implemented at every stage. Such testing will begin with a small group of users reacting to pre-prototype modeling and expand to larger groups, drawn from all segments of the user population, using pre-production models in real-world environments. This testing program will be designed and implemented to ensure that the next generation of talking-book equipment is fully evaluated by the group who will be using it.

Conclusion

It is absolutely critical that whatever the shape and function of the final product, it be capable of meeting the needs of all consumers, not just the young, not just the old, not just the technologically savvy, but also not just the technologically naive. Any future talking-book format must be usable and useful to everyone in the most flexible and efficient way possible.

Decisions will be made, and they must be made through a planned, rational process responsive to the needs of the community as a whole.

A service provider's responsibility is to the entire community it serves. It cannot respond to the needs presented by any single segment of the population without an objective assessment of the needs of the whole community.

Judith M. Dixon
Consumer Relations Officer

Bibliography

"Audio Committee Considers Current, Future Equipment." *News*, v. 24, January-March 1993: 4.

"Committee Tests Data Reduction in Audio Recording." *News*, v. 26, January-March 1995: 2-4.

Cookson, John P. *Technology Assessment and Research Program: A Draft for Discussion.* Washington, D.C.: National Library Service for the Blind and Physically Handicapped, 1992.

Cookson, John P. "An Audio Technology Assessment and Research Program." In *International Yearbook of Library Service for Blind and Physically Handicapped Individuals*. Compiled by Friends of Libraries for Blind and Physically Handicapped Individuals in North America. Munich, Germany: K.G. Saur, 1993. pp. 76-84.

Cookson, John P. "Twenty Steps to Next-Generation NLS Technology," NLS draft report, April 1997.

Cookson, John P., and Judith Dixon. "Transition from Analog to Digital Technology." *Proceedings of the Third International Meeting to Discuss Audio Technology as Applied to Library Service for Blind Individuals*, Toronto, April 1995.

Cookson, John P., and Lloyd Rasmussen. "Interfacing for Persons Who Are Blind and Physically Handicapped." *Enabling Technologies for High-Bandwidth Applications: Proceedings of SPIE, the International Society of Optical Engineering*, Boston, September 1992. SPIE proceedings series, v. 1785.

Cookson, John P., and Lloyd Rasmussen. "Future Distribution of Talking Books and Magazines." Technical Report. Washington, D.C.: National Library Service for the Blind and Physically Handicapped, March 1994.

Cookson, John P., and Lloyd Rasmussen. *A Technology Roadmap: Long-Term Strategic Technical Planning at NLS.* Washington, D.C.: National Library Service for the Blind and Physically Handicapped, 1997. (In preparation)

Cookson, John P., Lloyd Rasmussen, and Tom McLaughlin, "A Test of MPEG 1 Layer III Using Spoken Audio." Technical Report. Washington, D.C.: National Library Service for the Blind and Physically Handicapped, February 1995.

Cookson, John P., Lloyd Rasmussen, and George Stockton. "Talking Books: Toward a Digital Model." *Proceedings of the Conference Where Technology Meets the Information Age*, Center on Disabilities, California State University, Northridge, Calif., March 1997.

Cookson, John P., Lloyd Rasmussen, and Billy West. "Digital Collection-Access System Proposal." *Proceedings of the Third International Meeting to Discuss Audio Technology as Applied to Library Service for Blind Individuals*, Toronto, April 1995.

Crowley, Steven J. "A Review of Talking Book Technology: A Report Prepared for the Library of Congress by du Treil, Lundin, and Rackley." *Journal of Visual Impairment and Blindness*, v. 84, December 1990: 518-520.

Cylke, Frank Kurt. "Talking Book Technology." *Illinois Libraries*, v. 72, April 1990: 337-339.

Cylke, Frank Kurt. "Building a Solid Base for the Future: A Review of Current Activity." Presentation at the Annual Convention of the National Federation of the Blind, New Orleans, July 1997.

"Digital Recorded Research Links Past to Future." *Library of Congress Information Bulletin*, v. 46, no. 15, April 13, 1987: 149-151.

Digital-Talking-Book Technical Activity Planning. Washington, D.C.: National Library Service for the Blind and Physically Handicapped, 1997.

"Facts: Books for Blind and Physically Handicapped Individuals." Washington, D.C.: National Library Service for the Blind and Physically Handicapped, 1998.

"Four Agencies Plan Technical Cooperation." *News,* v. 21, April-June 1990: 16.

"International Delegates Consider Audio Technology." *News,* v. 26, July-September 1995: 1.

"International Meeting Confirms Cooperation." *News*, v. 23, July-September 1992: 1.

Majeska, Marilyn L. *Talking Books: Pioneering and Beyond.* Washington, D.C.: National Library Service for the Blind and Physically Handicapped, 1988.

McLaughlin, Tom, John P. Cookson, and Lloyd Rasmussen. "A Test of MPEG Using Time-Inverted Spoken Audio." *Proceedings of the IEEE 1996 International Conference on Acoustics, Speech, and Signal Processing*, May 1996.

Moodie, Michael M. "Digital Talking Books: Planning for the Future." Presentation at the Francophone Forum of the World Blind Union, Montreal, November 1997.

Nieland, Ruth A., and George F. Thuronyi. *Answering the Call: Telephone Pioneer Talking-Book Machine-Repair Program, 1960-1993.* Washington, D.C.: National Library Service for the Blind and Physically Handicapped, 1994.

"NISO Approves Standards Project for Digital Talking Book." *Library Hi Tech News*, #142, May 1997: 27.

"NISO Group Moves Ahead." *News*, v. 28, October-December 1997: 1-3.

"NISO Process Begins for Digital Audio Book." *News*, v. 28, July-September 1997: 1-2.

Paris, Henry B., Lloyd Rasmussen, and Judith Dixon. "The U.S. Talking Book System: Current and Future Requirements." *Resource Sharing and Information Networks*, v. 9, no. 1, 1993: 55-78.

Rasmussen, Lloyd, and John P. Cookson. "Designing Future Access for Patrons of the National Library Service for the Blind and Physically Handicapped (NLS)." *Proceedings of the 9th International Conference, Technology and Persons with Disabilities*, California State University, Northridge, Calif., March 1994.

"Significant Reduction Possible for Digital Storage." *News*, v. 27, July-September 1996: 3.

"Standard to Be Developed for Digital Talking Book," http://lcweb.loc.gov/nls/news-rel-97-02.html. Posted January 1997.

"Technology Team Works toward Future." *News*, v. 24, April-June 1993: 2.

That All May Read: Library Service for Blind and Physically Handicapped People. Washington, D.C.: National Library Service for the Blind and Physically Handicapped, 1983.

Linda Redmond
Head, Reference Section

Appendix I: Details to Be Considered in Implementing the Digital Talking-Book Program

Decision Matrix Theory

One way to solve a technology or any other type of problem is to employ mathematical techniques. We will use decision matrix theory. To begin the process, we will recognize and define the problem. Then gather all the facts from all the information sources, including engineering development models. Data collected will be classified into the following categories: facts, assumptions, criteria, opinions, and definitions. Of these data, facts and criteria are the most important. Then, we will list the possible solutions that have been developed concerning the types of players and media. Once the alternatives are determined, some will be eliminated because they do not meet established conditions or minimum standards.

Next, we will prepare a list of the advantages and disadvantages that result from testing each alternative against the stated evaluation criteria.

After testing each alternative against the stated criteria, we will compare the alternatives with one another using quantitative techniques such as a decision matrix, selected weights, and sensitivity analysis. These values will then be placed in a computer-generated mathematical model to determine which course of action is the best.

After generation of the computer model—whether a relative-value matrix or a multiplication matrix—we will summarize the results in language that is easy to read, perhaps in an appendix to the main report.

New Acquisition or Procurement

At the outset of any new acquisition, it is neither practical nor necessary to define and describe all the technical requirements down to the smallest detail. The requirements should be specified on a progressive basis as our program evolves, based on design revisions. Requirements will be stated in broad terms for the functional and performance characteristics, with little reference to how the characteristics will be achieved. This will allow our contracting personnel to use their ingenuity and experience in developing cost-effective and technically current designs. As the design process progresses through the acquisition phase into production of the design, requirements are identified in greater detail and the selective application of formal requirements can increase.

– Specifications and standards spell out the technical, procedural, quality, and documentation requirements necessary to complete the system or hardware acquisition. Whether addressing the use of a single specification standard or preparing a system specification, redundancy of the documents should be avoided. The use of each specification and standard will use "critical examination" to ensure that only the minimum acceptable standards are used. This process will consider the specific current technology from the decision matrix and a listing of the functional and operational requirements of the system, to ensure compatibility and avoid ambiguities.

Upon receipt of the operational requirement, the NLS engineering staff will complete the statement of work and the specifications depicting the course of action from the decision matrix. The specification will address both engineering and logistics concerns described earlier.

It is essential that NLS technical and Library of Congress procurement personnel work together to develop a Statement of Work (SOW) that describes the purpose, nature, and requirements of the work. The SOW identifies any tasks required under the scope of the contract and is the means by which the contractor is evaluated as the work progresses. It will be developed by reducing the range of possible requirements to the least acceptable requirements.

Documents specifically cited and those directly referenced in the SOW are contractually binding on the contractor.

Issuing a draft SOW to those in industry will allow interested organizations to review and comment on the ability to produce our product. The federal solicitation process is the vehicle by which the government advertises to industry to purchase goods and services. A draft request for proposals (RFP) will be sent out to industry for comment prior to the actual solicitation. Then an industry-wide forum may be held to receive input on the approach. Once the input is gathered, the NLS team will refine the RFP and issue the solicitation via the *Commerce Business Daily*. Various industry representatives then respond with their best offers. The technical and cost committees then analyze their respective sections of the proposals.

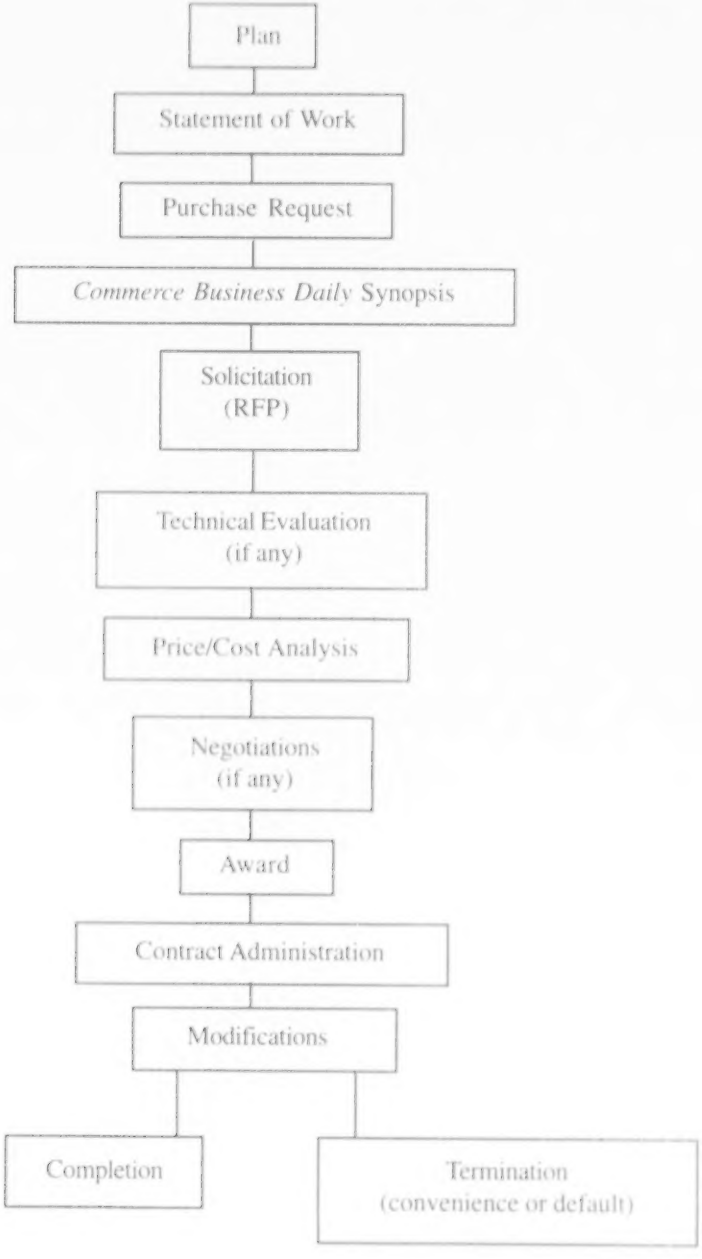
The technical and cost committees will respond to possible contractors with questions about their proposals to determine whether the proposals are acceptable, unacceptable but can be made acceptable through discussions, or unacceptable. The contractors will respond to the questions, and then the technical and cost teams review the proposals to determine which contractor is best able to meet the operational requirements. For all acceptable proposals, an audit will be initiated to ensure fair pricing. When this review is completed, the contracting officer will hold discussions and call for "best and final offers" before awarding the contract.

After the contract is awarded, a post-award meeting will be held to allow team building between the government and the contractor and to ensure that all tasks are clearly understood before production begins.

Note: Some of the information concerning decision matrix theory was derived from materials found in the Combined Arms Staff and Services School 1998 Problem Solving Decision Matrix handouts, F-121, from the U.S. Army at Fort Leavenworth, Kansas. The new acquisition or procurement information was derived from material in the Naval Air Systems Command Acquisition Course.

Wells B. Kormann
Chief, Materials Development Division

Appendix II: The Contracting Process



Request for Proposals Development

1. Conduct initial research on the contracting needs and requirements of the agency.
2. Designate the principal writer or establish a writing team for the Statement of Work.
3. Write the scope of work to be covered by the contract; review budgets and costs.
4. Obtain and complete the applicable clearance forms and documents for the new contract.
5. Identify the type of contract most suitable for the agency's needs and requirements.
6. Establish internal panels and procedures for reviewing the Statement of Work.
7. Develop a plan for evaluating the proposals received; establish a proposal evaluation panel.
8. Formulate criteria for evaluating the technical proposals received.
9. Develop a list of qualified vendors or offerors to whom the RFP should be distributed.
10. Prepare a detailed outline for each major section of the Statement of Work.
11. Write a draft version of the entire Statement of Work.
12. Present the draft version of the work statement for internal agency reviews.
13. Write the final version of the Statement of Work, incorporating reviewers' recommendations.
14. Announce the availability of the RFP via a synopsis in *Commerce Business Daily*.
15. Distribute the RFP to organizations on the "source list" and to others requesting a copy.

16. Set up a "reading room" (background documents); convene a preproposal, "bidders" conference.
17. Deadline for submitting proposals; begin the evaluation of technical proposals.
18. Schedule oral presentations by offerors; begin technical negotiations.
19. Award the contract.
20. Begin monitoring the contractual project.

Credit: "RFP Planners Guide." RFP, Inc.

Key Technical Components of Requests for Proposals

1. Table of Contents. Reveals how the technical content of the RFP is organized.
2. Background Statement. Describes the evolution of, and rationale for, the agency's requirements and needs.
3. Scope of Work. Delimits the types of work and services covered by the RFP.
4. Description of Tasks. Explains what the contractor will be required to do.
5. Deliverable Items. Describes or defines the items to be provided by the contractor.
6. Delivery/Completion Schedule. Sets dates for the completion of tasks or the delivery of items.
7. Performance Criteria. Refers to or defines the criteria for inspecting, testing, accepting, rejecting, etc. the contractor's work.
8. Contract Monitoring. Presents the means to be used to monitor the progress and quality of the work.
9. Personnel Requirements. Specifies the qualifications and types of skills required for the work; estimates levels of effort.
10. Government-Furnished Assistance. Identifies the property, services, equipment, facilities, etc. to be made available to the contractor.
11. Attachments and Appendixes. Provides supporting documentation that helps offerors understand the government's requirements and needs.
12. Evaluation Criteria. Presents the factors and criteria for evaluating the merits of proposals submitted by offerors.

Credit: "RFP Planner's Guide," RFP, Inc.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1998 – 432 - 386 / 80007